

Stepper Motor Interfacing with Firebird V LPC2148 ARM7

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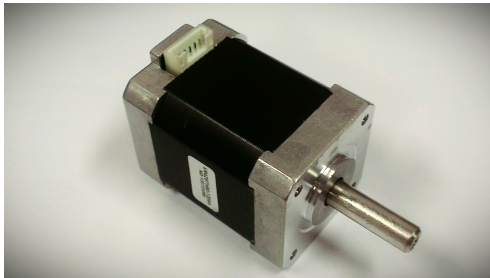


Agenda for Discussion

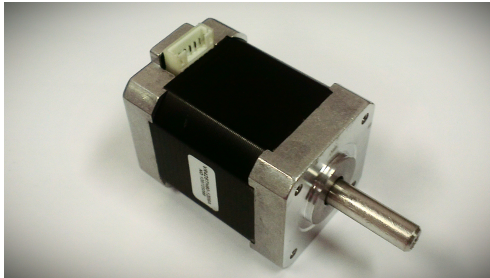
- 1 Introduction
 - What is a stepper motor?
 - Types of Stepper Motors
- 2 Controlling a Stepper Motor
 - Stepping sequences
 - Wave Stepping
 - Full Stepping
 - Half Stepping
 - Comparison of stepping modes
- 3 Identifying the wires of a stepper motor
- 4 Stepper Motor Driver
- 5 Interfacing with LPC2148
 - GPIO pins
 - Code



What is a stepper motor?



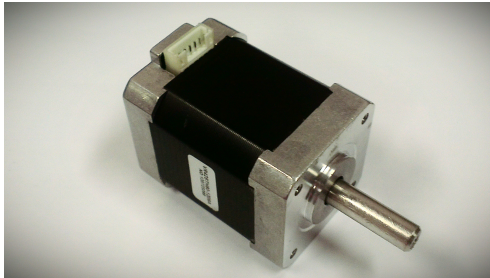
What is a stepper motor?



- ① Rotates in discrete steps



What is a stepper motor?



- ① Rotates in discrete steps
- ② Can hold or move to a position

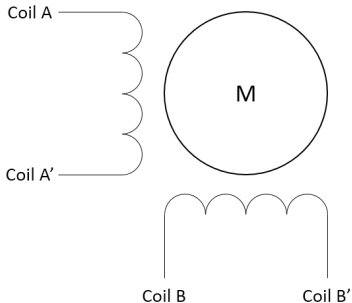


Types of Stepper Motors



Types of Stepper Motors

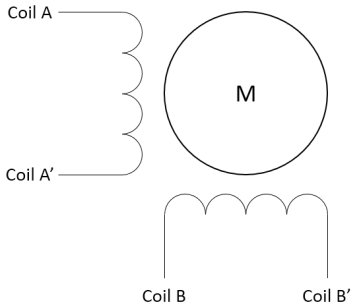
- Bipolar
 - Has 4 wires



Types of Stepper Motors

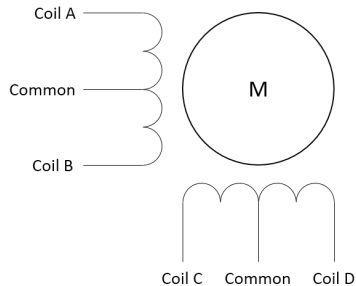
- Bipolar

- Has 4 wires



- Unipolar

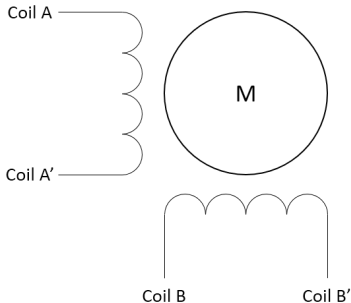
- Has 5 or 6 wires



Types of Stepper Motors

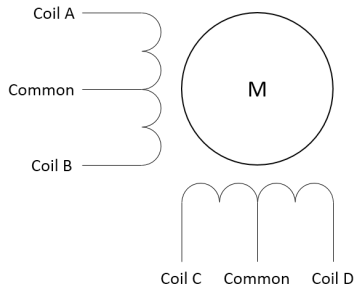
- Bipolar

- Has 4 wires



- Unipolar

- Has 5 or 6 wires



We will use a unipolar stepper motor.



Stepping sequences



Stepping sequences

① Wave Stepping



Stepping sequences

- 1 Wave Stepping
- 2 Full Stepping



Stepping sequences

- ❶ Wave Stepping
- ❷ Full Stepping
- ❸ Half Stepping



Wave Stepping



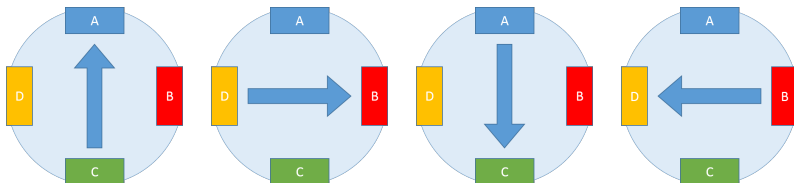
Wave Stepping

Step	Coil A	Coil B	Coil C	Coil D
1	1	0	0	0
2	0	1	0	0
3	0	0	1	0
4	0	0	0	1

Table : Wave stepping sequence



Wave Stepping (contd.)



Stepper Motor's positions in the wave stepping sequence



Full Stepping



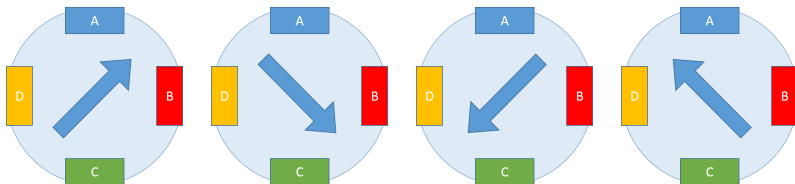
Full Stepping

Step	Coil A	Coil B	Coil C	Coil D
1	1	1	0	0
2	0	1	1	0
3	0	0	1	1
4	1	0	0	1

Table : Full stepping sequence



Full Stepping (contd.)



Stepper Motor's positions in the full stepping sequence



Half Stepping



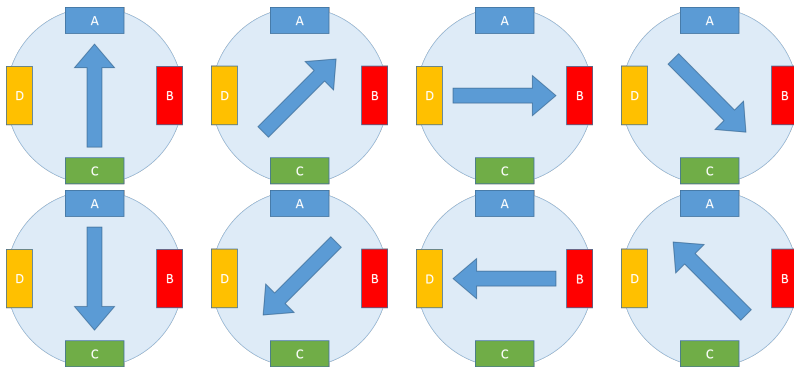
Half Stepping

Step	Coil A	Coil B	Coil C	Coil D
1	1	0	0	0
2	1	1	0	0
3	0	1	0	0
4	0	1	1	0
5	0	0	1	0
6	0	0	1	1
7	0	0	0	1
8	1	0	0	1

Table : Half stepping sequence



Half Stepping (contd.)



Stepper Motor's positions in the half stepping sequence



Comparison of stepping modes



Comparison of stepping modes

Stepping Mode

- 1 Torque
- 2 Vibration
- 3 Speed
- 4 Resolution

Wave Stepping

- 1 Lowest
- 2 Intermediate
- 3 Full
- 4 Normal

Full Stepping

- 1 Highest
- 2 Highest
- 3 Full
- 4 Normal

Half Stepping

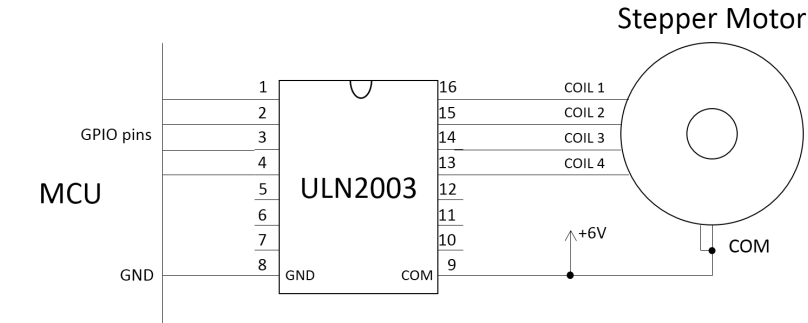
- 1 Intermediate
- 2 Lowest
- 3 Halved
- 4 Doubled



Identifying the wires of a stepper motor



Stepper Motor Driver Circuit



Interfacing with LPC2148

GPIO pins



Interfacing with LPC2148

GPIO pins

JTAG connector pin	MCU pin	Connected to
11	P1.26	ULN2003 pin 1
13	P1.27	ULN2003 pin 2
5	P1.28	ULN2003 pin 3
9	P1.29	ULN2003 pin 4
4	GND	ULN2003 pin 8

Table : GPIO pins used



Interfacing with LPC2148

GPIO pins

JTAG connector pin	MCU pin	Connected to
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4	GND	ULN2003 pin 8

Table : GPIO pins used

19	17	15	13	11	9	7	5	3	1
20	18	16	14	12	10	8	6	4	2

Figure : Pin numbering on the JTAG connector



Interfacing with LPC2148

Code



Interfacing with LPC2148

Code

```
#include
```

```
#include <lpc214x.h>  
#include "stepper.h"
```



Interfacing with LPC2148

Code

#include

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#include <lpc214x.h>  
#include "stepper.h"
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Main Program

```
int direction = 1;  
int count = 0;  
int main(void)  
{  
    stepper_port_init();//Initialize ports
```



Interfacing with LPC2148

Code

#include

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#include <lpc214x.h>
#include "stepper.h"
```

Main Program

```
int direction = 1;
int count = 0;
int main(void)
{
    stepper_port_init();//Initialize ports
    while(1)
    {
        full_step(direction);
```



Interfacing with LPC2148

Code

#include

```
#include <lpc214x.h>
#include "stepper.h"
```

Main Program

```
int direction = 1;
int count = 0;
int main(void)
{
    stepper_port_init();//Initialize ports
    while(1)
    {
        full_step(direction);
        DelaymSec(10); //10 ms between steps equals 100Hz
    }
}
```



Interfacing with LPC2148

Code

#include

```
#include <lpc214x.h>
#include "stepper.h"
```

Main Program

```
int direction = 1;
int count = 0;
int main(void)
{
    stepper_port_init();//Initialize ports
    while(1)
    {
        full_step(direction);
        DelaymSec(10); //10 ms between steps equals 100Hz
        if(count++ >= 200) //Change direction every revolution
        {
            direction = -1 * direction;
            count = 0;
        }
    }
}
```



Interfacing with LPC2148

Code (contd.)

Port Initialisation

```
#define STEPPERPORTDIR IO1DIR
#define COILAPIN 26
#define COILBPIN 27
#define COILCPIN 28
#define COILDPIN 29
void stepper_port_init()
{
    PINSEL2 = (PINSEL2 & 0x8);
    STEPPERPORTDIR |= (1<<COILAPIN) | (1<<COILBPIN) |
        (1<<COILCPIN) | (1<<COILDPIN);
}
```



Thank You!

Send your queries to: helpdesk@e-yantra.org

